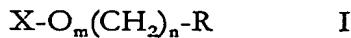


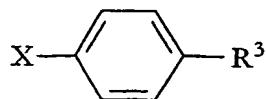
Claims

1. An ionic dopant comprising a sulfur or a phosphorus containing anion with a random cation, for use in a smectic A liquid crystal composition, wherein the dopant is capable of reducing the driving voltage of the smectic A liquid crystal device and enhancing dynamic light scattering.
2. An ionic dopant as claimed in claim 1, wherein the sulfur or phosphorus containing anion comprises X, and X is one of the following S^- , SO_2^- , SO_3^- , SO_4^- , $NHSO_3^-$, POH^- , PO_2H^- , PO_3H^- , $(PO_3)^{2-}$, PO_4H^- or $(PO_4)^{2-}$.
3. An ionic dopant as claimed in either of the preceding claims, wherein the anion is according to formula I:



wherein X is S, SO_2 , SO_3 , NHSO_3 , POH , PO_2H , PO_3H or $(\text{PO}_3)^2$; m is 0 or 1; n is 0 to 19; and R is R^3 , R^1R^3 , $\text{R}^1-(\text{CO}_2)-\text{R}^3$, $\text{R}^1-(\text{CO}_2)-\text{R}^2\text{R}^3$, $\text{R}^1-(\text{CH}_2)_p-\text{R}^3$, or $\text{R}^1-(\text{CH}_2)_p-\text{R}^2\text{R}^3$, wherein R^1 is a phenyl, a substituted phenyl, a biphenyl, a substituted biphenyl, a terphenyl, a substituted terphenyl, an aromatic ring, a non-aromatic ring, a cyclohexyl, a cyclopentyl, a diazine, a bidiazine, a terdiazine, a phenyldiazine, a biphenyldiazine, a naphthalene or an azanaphthalene; R^2 is a phenyl, a substituted phenyl, a biphenyl, a substituted biphenyl, a terphenyl, a substituted terphenyl, an aromatic ring, a non-aromatic ring, a cyclohexyl, a cyclopentyl, a diazine, a bidiazine, a terdiazine, a phenyldiazine, a biphenyldiazine, a naphthalene or an azanaphthalene; R^3 is a hydrogen, a cyano group, an alkyl chain, an alkyl substituted cyclohexyl, an alkenyl chain, an alkyl chain wherein one or more non-adjacent CH_2 -groups are replaced by an oxygen atom; and p is 0 to 19.

4. An ionic dopant as claimed in claim 3, wherein the anion comprises:



wherein X is SO_3^- , $(\text{PO}_3\text{H})^-$, PO_3^{2-} , and R^3 is an alkyl or alkoxy chain.

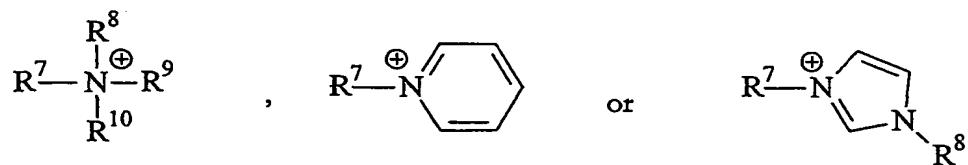
5. An ionic dopant as claimed in claim 1, wherein the anion is chiral.
6. An ionic dopant comprising a quaternary ammonium cation with an anion, for use in a smectic A liquid crystal composition, wherein the dopant is capable of reducing the driving voltage of the smectic A liquid crystal device and enhancing dynamic light scattering.
- 10 7. An ionic dopant as claimed in any one of claims 1-4, wherein the cation is a quaternary ammonium cation.
8. An ionic dopant as claimed in any one of the preceding claims, wherein the cation is based on a heterocyclic base.
- 15 9. An ionic dopant as claimed in claim 7, wherein the cation is based on an N-alkylpyridine, an N-N'-dialkylimidazole an N-N'-dialkylbenzimidazole, an N-N'-dialkyltriazole, an N-alkylquinuclidine or an N-alkylazanaphthalene.
- 20 10. An ionic dopant as claimed in any one of the preceding claims, wherein the cation is according to formula II:



25 wherein Y is $\text{NR}^4\text{R}^5\text{R}^6$ wherein R^4 , R^5 and R^6 is in every instance an alkyl group or an alkyl chain containing 0 to 5 carbon atoms, pyridines, N-alkylimidazoles, N-alkylbenzimidazoles, N-alkyltriazoles, alkylquinuclidines or alkylazanaphthalenes, q is 0 to 19; and R is R^3 , R^1R^3 , $\text{R}^1-(\text{CO}_2)-\text{R}^3$, $\text{R}^1-(\text{CO}_2)-\text{R}^2\text{R}^3$, $\text{R}^1-(\text{CH}_2)_p-\text{R}^3$, or $\text{R}^1-(\text{CH}_2)_p-\text{R}^2\text{R}^3$, wherein R^1 is a phenyl, a substituted phenyl, a biphenyl, a substituted biphenyl, a terphenyl, a

substituted terphenyl, an aromatic ring, a non-aromatic ring, a cyclohexyl, a cyclopentyl, a diazine, a bidiazine, a terdiazine, a phenyldiazine, a biphenyldiazine, a naphthalene or an azanaphthalene; R² is a phenyl, a substituted phenyl, a biphenyl, a substituted biphenyl, a terphenyl, a substituted terphenyl, an aromatic ring, a non-aromatic ring, a cyclohexyl, a cyclopentyl, a diazine, a bidiazine, a terdiazine, a phenyldiazine, a biphenyldiazine, a naphthalene or an azanaphthalene; R³ is a hydrogen, a cyano group, an alkyl chain, an alkyl substituted cyclohexyl, an alkenyl chain, an alkyl chain wherein one or more non-adjacent CH₂-groups are replaced by an oxygen atom; and p is 0 to 19.

11. An ionic dopant as claimed in any one of the preceding claims, wherein the cation is:



where R⁷, R⁸, R⁹ and R¹⁰ are alkyl chains.

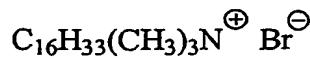
12. An ionic dopant as claimed in any one of the preceding claims, wherein the cation is *n*-hexadecyltrimethylammonium (HTMA) or *n*-hexadecyldimethylethylammonium (HDME).

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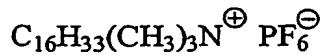
13. An ionic dopant as claimed in claim 7, wherein the cation is chiral.

14. An ionic dopant as claimed in any one of the preceding claims, wherein the dopant is:

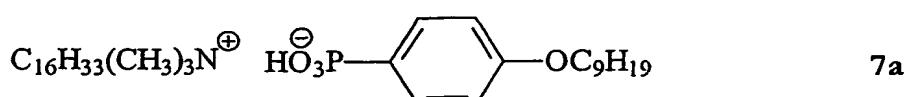
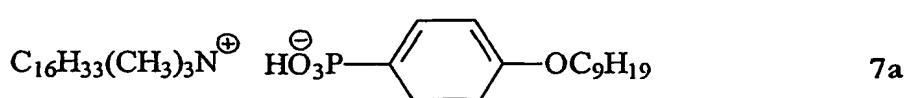
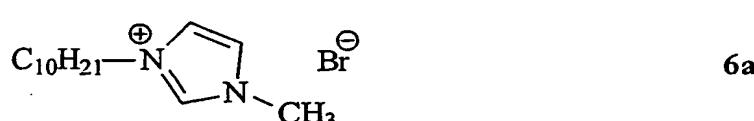
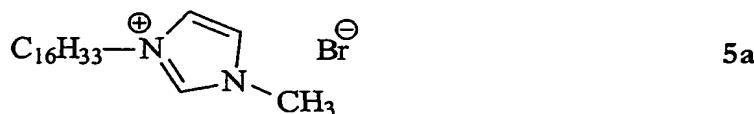
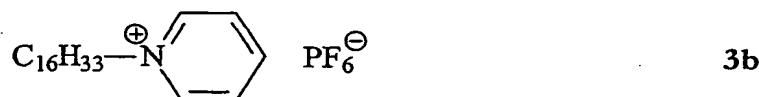
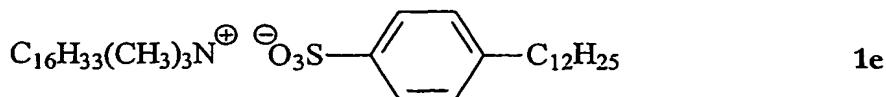
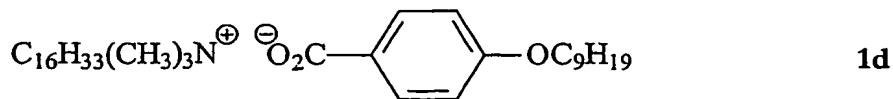
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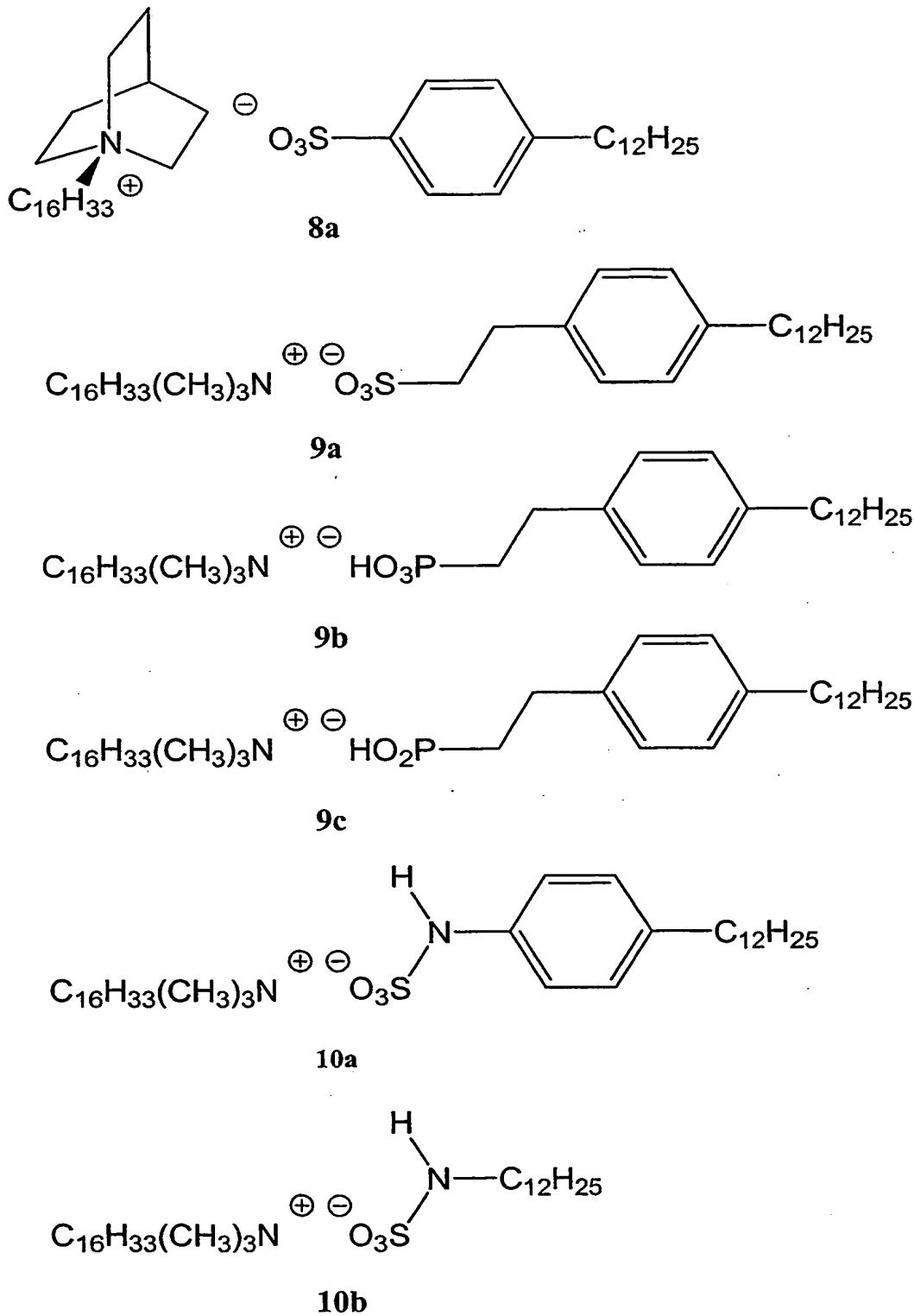


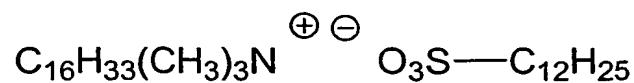
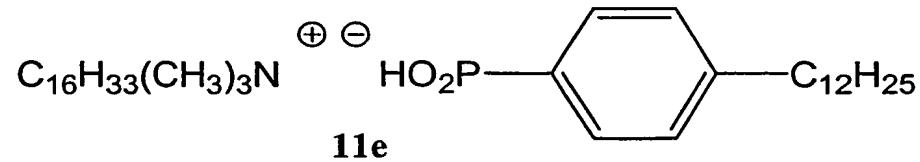
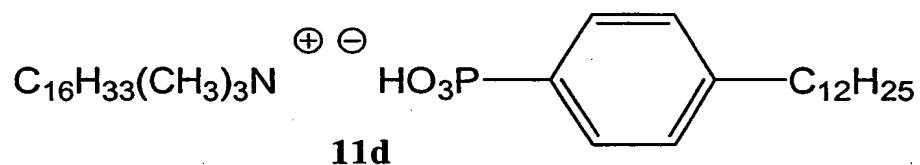
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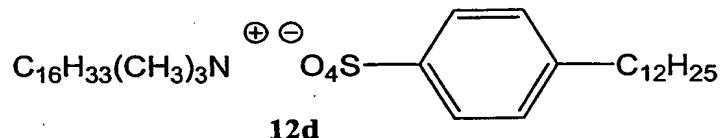
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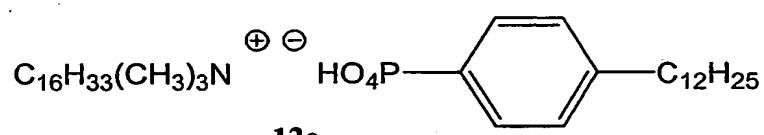
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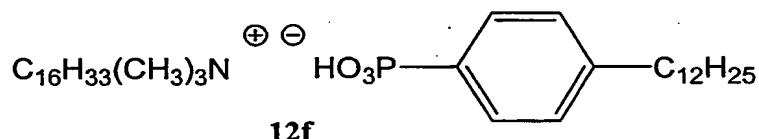
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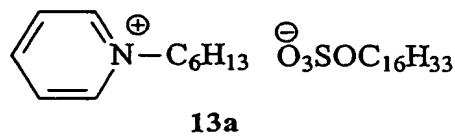
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12e



12f



13a

5 15. A smectic A liquid crystal composition comprising one or more ionic dopants as claimed in any one of the preceding claims.

16. A device containing a smectic A liquid crystal composition as claimed in claim 15.

17. A device as claimed in claim 16, wherein the device is a display or a light shutter.

18. A method of doping a smectic A liquid crystal composition, by adding an ionic dopant as claimed in any one of claims 1-14 to a smectic A liquid crystal composition.